

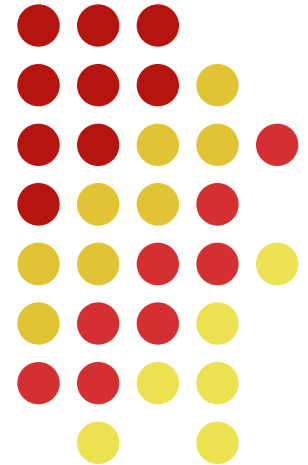
Roadway Design Factors and Drowsy Driving: Roadside Rest Areas & Rumble Strips

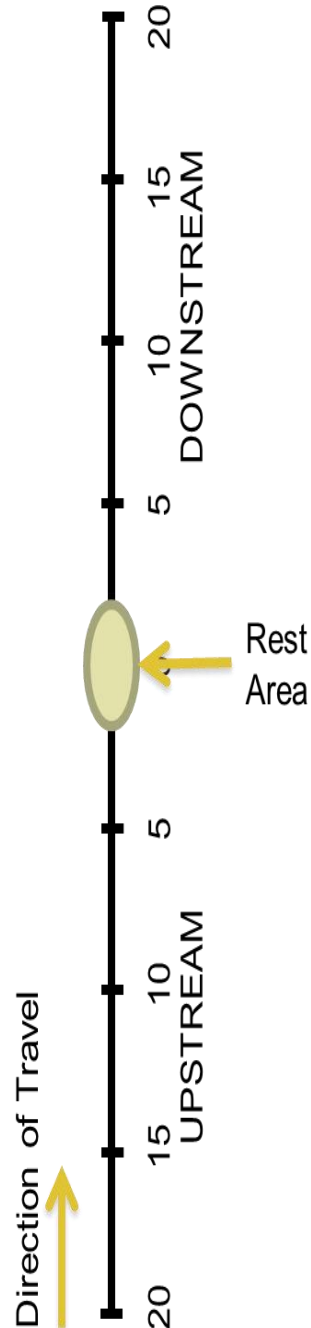
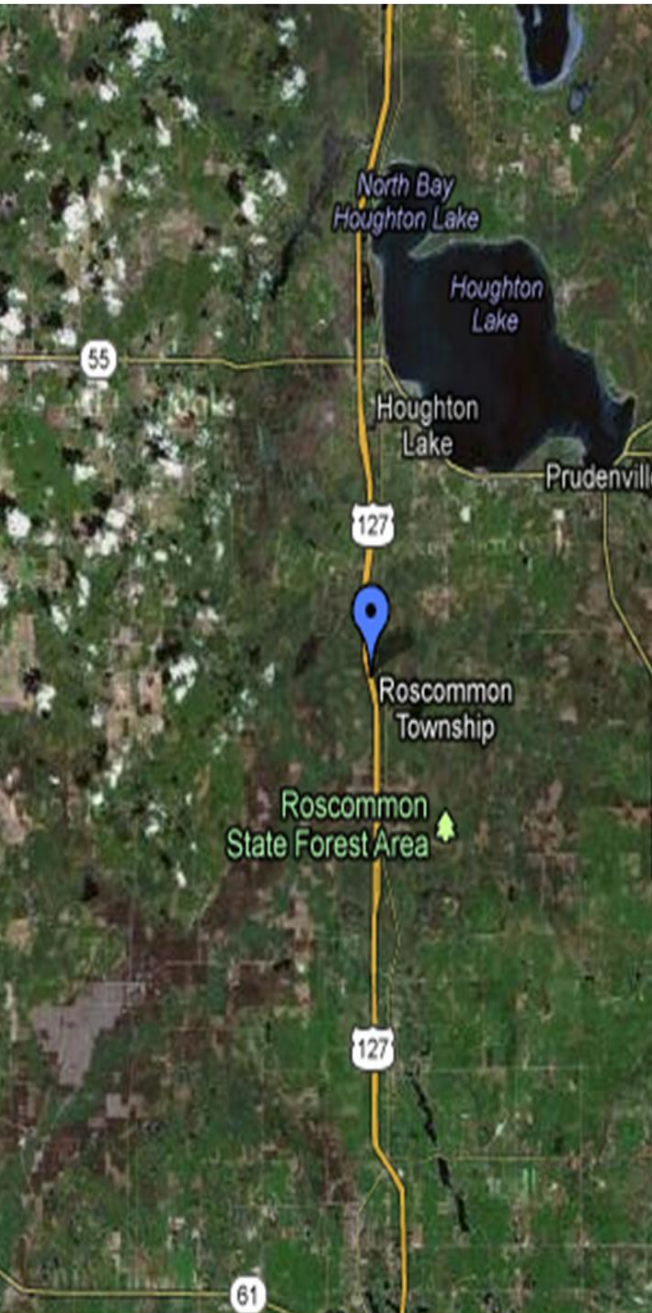
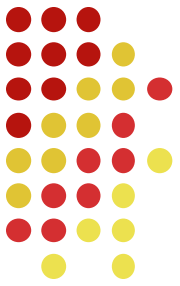


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NTSB Public Forum on Drowsy Driving

October 21, 2014

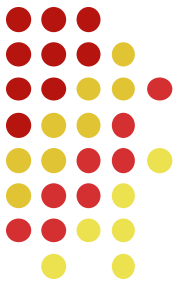




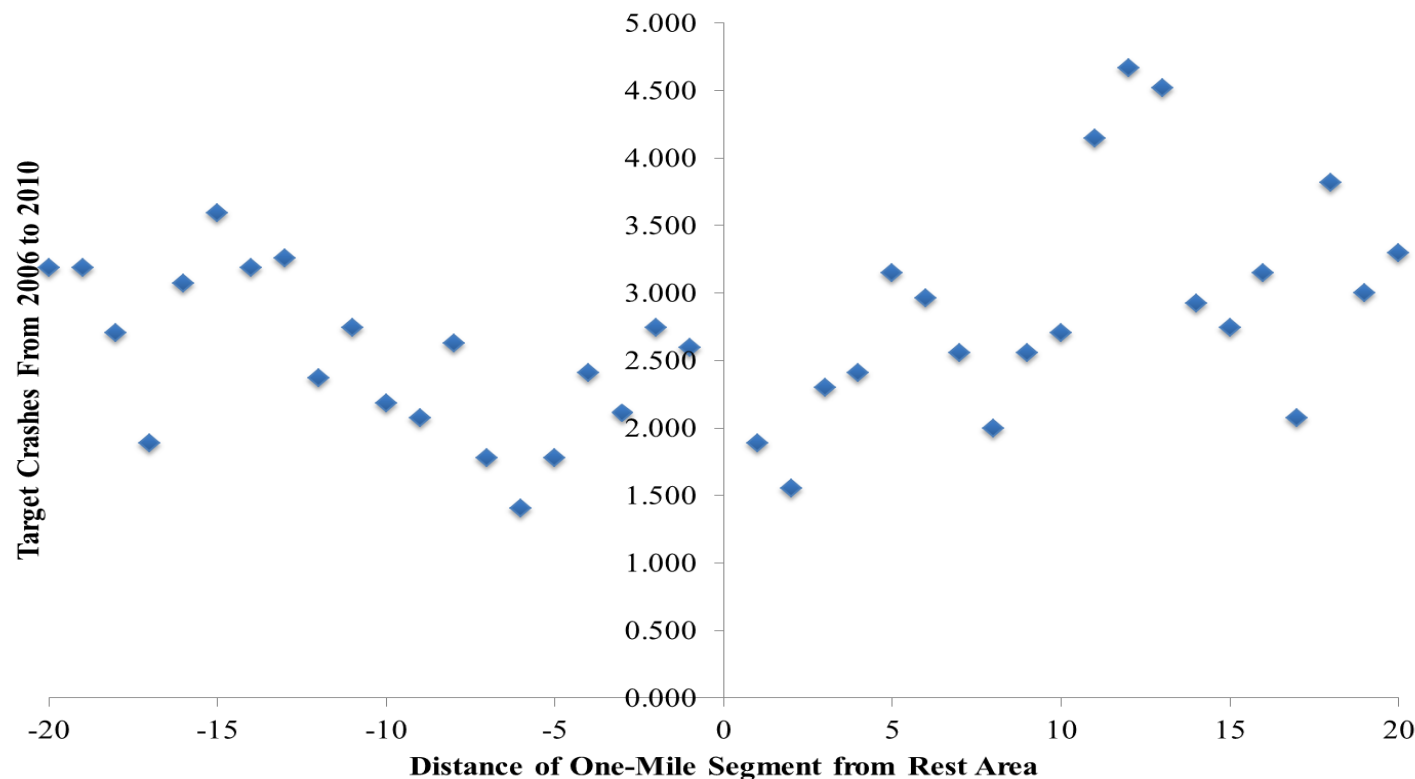
Countermeasure 1: Roadside Rest Areas

**Fatigue-related crashes
= f(rest area spacing)**

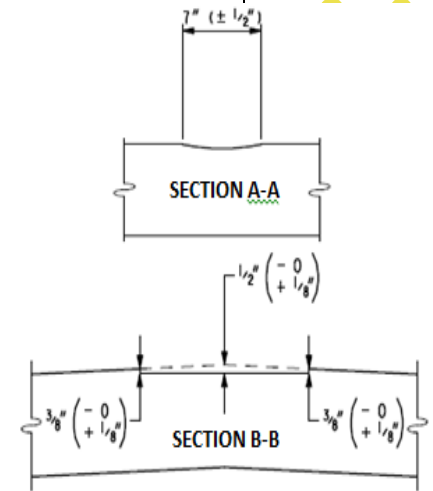
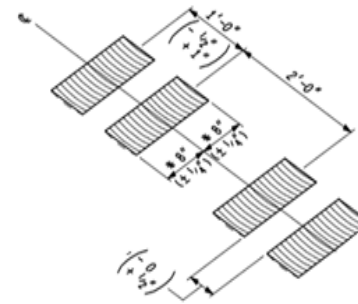
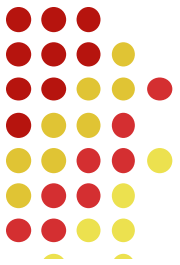
Average Number of Crashes by Distance from Rest Area



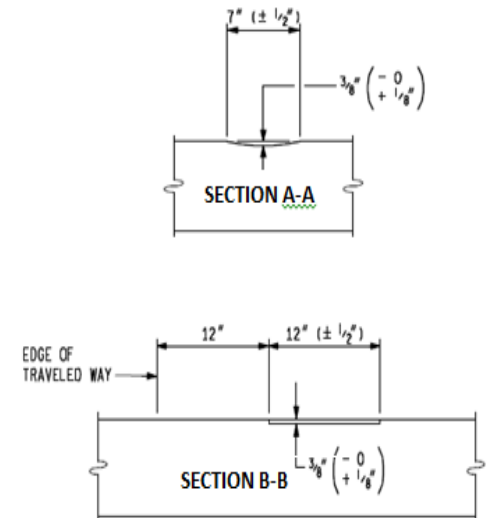
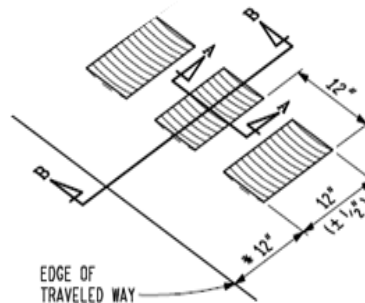
- For every mile upstream/downstream of the rest area:
 - Crashes increased by 1.8% on freeways
 - Crashes increased by 7.5% on two-lane highways



Countermeasure 2: Centerline & Shoulder Rumble Strips

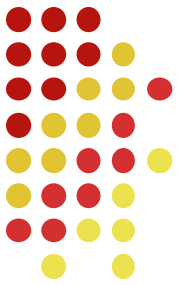


a. Centerline Rumble Strips



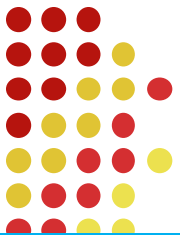
b. Shoulder Rumble Strips

Relevance to Drowsy Driving



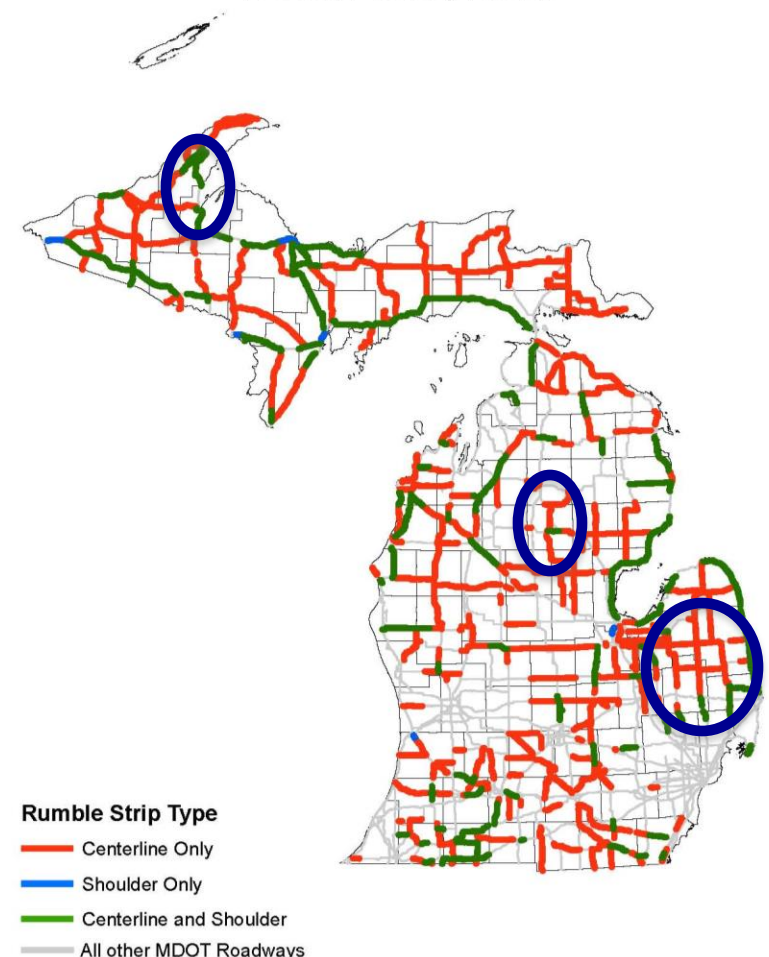
- Rumble strips have been shown to reduce lane departure crashes, injuries, and fatalities.
- What behavioral changes have facilitated these crash reductions?
- Are there incremental effects of using shoulder rumble strips in conjunction with centerline rumble strips?

Field Study Locations



- 5 two-lane roadways with CLRS-only
 - ADT range: 1,500 – 5,300
 - 10 passing zones
 - 8 curves/adjacent tangents
- 5 two-lane roadways with CLRS and SRS
 - ADT range: 3,300 – 6,000
 - 8 passing zones
 - 4 curves/adjacent tangents

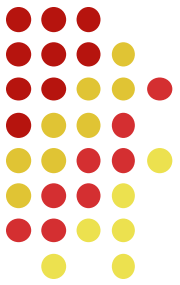
Rumble Strip Installation Locations
2008, 2009, 2010





IOWA STATE
UNIVERSITY

Lane Positioning Results



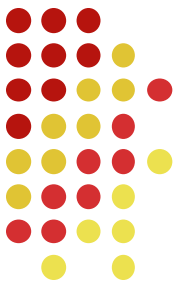
CLRS-Only

Segment Type	CENTERED		
	Before	After	Significant Difference?
Tangent	36.3%	48.4%	Yes
Left Curves	33.1%	54.9%	Yes
Right Curves	24.7%	45.3%	Yes

50,000 total
Before & After
vehicular
observations

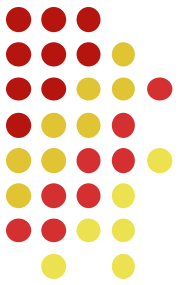
CLRS & SRS

Segment Type	CENTERED		
	Before	After	Significant Difference?
Tangent	34.9%	68.7%	Yes
Left Curves	33.8%	72.5%	Yes
Right Curves	34.6%	67.5%	Yes



Encroachment Results

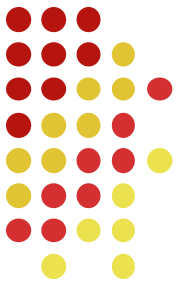
Segment Type	EDGELINE Encroachment Rate			CENTERLINE Encroachment Rate		
	Before	After	Significant Difference?	Before	After	Significant Difference?
Tangent	10.5%	6.6%	Yes	1.5%	0.6%	Yes
Left Curves	13.2%	4.5%	Yes	11.9%	1.5%	Yes
Right Curves	11.6%	6.6%	Yes	0.6%	0.4%	No



Conclusions

- Roadside rest areas
 - Decrease “fatigue-related” crashes in the vicinity of rest areas up to a distance of 20 miles
 - Effects are more pronounced on two-lane highways
- Centerline rumble strips (CLRS)
 - Improve central lane positioning tendencies
 - Decrease centerline encroachments
- Shoulder rumble strips (in addition to CLRS)
 - Further improve lane-keeping
 - Decrease edgeline encroachments

Thank You!



Questions?

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